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TITLE

SELECTIVE CUTTING FOR THE PREVENTION OF TIMBER LOSS CAUSED BY INSECTS

HOG LAKE COMPARTMENT

HAPPY CAMP - LAVA BEDS AREA. MODOC NATIONAL FOREST, CALIFORNIA

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by

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Berkeley, California
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SELECTIVE CUTTING FOR THE PREVENTION OF TIMBER LOSS CAUSED BY INSECTS

HOG LAKE COMPARTMENT

HAPPY CAMP - LAVA BEDS AREA, MODOC NATIONAL FOREST, CALIFORNIA

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SELECTIVE CUTTING FOR THE PREVENTION OF TIMBER LOSS CAUSED BY INSECTS

HOG LAKE COMPARTMENT

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INTRODUCTION

The advent of mobile logging methods and equipment in recent years has brought considerable change into the plans and policies advocated by foresters for the management of the extensive stands of ponderosa pine east of the Sierra Nevada range in California. Gradually, as trucks and caterpillars have replaced railroad operations, it has been possible to promote mobile logging into previously inaccessible areas and make lighter cuttings on a profitable basis. Recently in timber management plans for the sustained-yield production of saw logs from these areas, a preliminary light cut of a timber tract has been planned in order to gain control over losses in the stand which were caused by insects.

During the past two decades, the Modoc National Forest in California has suffered a number of severe outbreaks of bark beetles. At the present time, in some local areas, the cumulative loss as a result of insect attack has been so great that it is doubtful whether the remaining green stand is now merchantable. For the most part the immediate problem to be met with in plans for intensive forest management in these "east-side" pine stands is the control of insects.

For the past several years it has been recommended that insect control practices in the pine stands of the east-side forest areas should be incorporated into the management plans for cutting. It was felt that the initial phase of a cutting program should be the removal of all trees most likely to be attacked and killed by insects. A relatively light preliminary cut would allow for the immediate harvest of large quantities of susceptible timber over extensive areas which would be killed otherwise by insects and lost from possible utilization.

In the forest management plan for the Alturas Working Circle on the Modoc National Forest, a large tract of government-owned timber in the Happy Camp - Lava Beds Area was put up for sale on a light cutting basis. Sanitation-salvage logging methods were planned as a measure for the control of insects. Early in 1942, the R. L. Smith Company at Canby, California, purchased through exchange the timber on the Hog Lake Compartment of the Unit Area and agreed to make the selective cutting by removing a minimum of 25 percent of the merchantable stand in trees which were judged as being highly susceptible to insect attack. The sale of this timber culminated several years of effort by the Forest Service to initiate intensive forest management for this Area.

OBJECTIVES OF THE CUTTING PROGRAM

The primary objective of the light sanitation-salvage program was to gain control over the insects and thereby preserve the remaining stand for utilization cutting at a future date. The removal of a small percentage of the stand would allow a rapid coverage of the area during a given period and thereby provide for the harvest of a majority of the potential "bug loss" of future years.

The prospects were good that the initial light cut on the Hog Lake Compartment would provide adequate protection to the reserve stand in this area. Plans for subsequent cutting were that the sale unit would extend northwest into an area of higher insect hazard (Figure 1) and a lower stand volume per acre. It had previously been recommended (1) that cutting in the higher zone of hazard be made on a full utilization basis as there was little assurance that the reserve stand of low risk trees in the hazardous area would remain immune to subsequent bark beetle attacks during severe beetle epidemics likely to develop in these fringe areas. Also, the removal of all high risk trees from a high hazard zone in one cutting would yield only a small cut and then leave but a relatively small volume per acre to be removed at a later date.

DEVELOPMENT OF MARKING PRACTICE

In the development of plans for cutting this tract of timber, the Forest Service estimated that about 25 percent of the stand should be cut to remove all high risk trees. From the Inventory of Hazard (1) in this area in 1939, it was determined that the total volume in high risk trees was about 2,025 board feet per acre or 19.6 percent of the green stand. In the marking practice, therefore, it was considered advisable not only to remove all high risk trees, but also to remove any tree when it was doubtful whether the tree was a risk 2 or risk 3. The agreement in the timber sale contract for a minimum cut of 25 percent of the stand made it possible to mark all of the borderline trees between the risk 2 and risk 3 groups without exceeding the minimum cut to any large degree. Particular attention was given to the selection of trees bordering between low and high risk, however, as the objective of the light cut was to remove only the high risk trees and thereby allow for as rapid a coverage of as much area as possible during the season. All marking on the sale areas was done by the Forest Service personnel administering the sale agreement. Assistance in training the markers in picking out high risk trees was made by P. C. Johnson and J. W. Bongberg of the Berkeley Forest Insect Laboratory during April, 1942.

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1. Miller, J.M.; K.A. Salman; and P. C. Johnson - 1941, Bark Beetle Hazards in the Pine Stands of Northeastern California. Mimeographed report. Berkeley, California

STAND CHARACTERISTICS *

The Hog Lake Compartment of the Happy Camp - Lava Beds Area (Figure 1) is typical of the relatively pure ponderosa pine stand common to the Modoc plateau region. The entire area is uniformly flat. There are a number of sizable openings in the timber where winter precipitation accumulates as surface lakes during early spring and summer months. The timber is of average quality, but relatively short. The site quality ranges between IV and V. The stand is practically all overmature. Sporadic outbreaks of bark beetles have created many openings as large groups of trees have been killed. The ground cover is largely sage and bitter brush. Large patches of reproduction are abundant over the area, but for the most part these have become stagnant from competition. Some trees of the younger age classes are gradually filling the openings created where portions of the over-story have been killed. An occasional outcropping of bare lava is found in narrow surface reefs. The soil over the lava surface is shallow.

The green stand of ponderosa pine in the timbered sections of the Hog Lake Compartment varies from one part of the area to another. In the Inventory of Hazard in 1939, Johnson has estimated the average stand volume at about 10,300 board feet per acre. Local 40 acre units contain volumes well above the average, but these are offset by other areas that are sparsely stocked. For the most part, the proportion of the stand in high risk trees is fairly uniform throughout. A summary of the stand characteristics as determined from sample cruise strips made by the Hazard Inventory Field Party in 1939 is given in the following table.

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* Two sources of field data are used for describing the stand characteristics of this sale area. (1) Basic data obtained by P. C. Johnson in the Hazard Inventory of the Happy Camp - Lava Beds Area in 1939; and, (2) the cruise strips of cut and leave trees which were made by the Forest Service personnel administering this sale.

Table 1. Stand Resources. Hog Lake Compartment. Happy Camp - Lava Beds Area.

Acres in Sample	Total Green: No. of Trees	Total Green: Volume BM	Total Green: Volume per acre	Total High Risk: Volume BM	Total High Risk: Volume per acre	Total High Risk: Percent Green
8.0	90	97,600	12,200	17,180	2,145	17.6
8.0	81	65,680	8,210	13,020	1,628	19.8
8.0	104	88,650	11,080	20,440	2,555	23.1
8.0	132	110,530	13,820	19,690	2,461	17.8
7.0	47	41,500	5,930	4,340	620	10.5
6.6	48	40,070	6,070	4,630	702	11.6
8.0	92	82,340	10,290	23,020	2,878	28.0
4.6	44	30,900	6,720	590	128	2.2
4.7	46	37,930	8,070	11,250	2,394	29.7
6.3	51	56,810	9,020	18,600	2,952	32.7
5.1	67	58,640	11,500	4,050	794	6.9
4.0	55	39,600	9,900	9,850	2,463	24.9
5.5	55	42,720	7,770	3,130	569	7.3
4.8	29	25,800	5,380	8,150	1,698	31.6
2.0	28	16,040	8,020	1,510	755	9.4
Total 90.6	969	834,810		159,450		
Average			9,210		1,760	19.1

A further determination of stand conditions on the sale area was made as the practice in marking was developed. At this time, a 40-acre plot representative of most of the sale area was established as a sample unit. On this plot, the green stand averaged 10,500 board feet per acre. The volume in high risk trees was slightly above that shown by the hazard inventory and when the borderline risk two trees were added, 29.8 percent of the green volume had been marked for cutting.

PRACTICE IN CUTTING

Throughout the period when the sale area was being marked, a periodic check was made of the proportions of the stand selected for cutting. These sample cruise strips were maintained by the markers to help guide them in their selection of borderline risk two trees for supplementing the high risk volume for the minimum cut of 25 percent as provided by contract. A summary of the sample cruise strips made by the Forest Service is given in table 2.

Table 2. Green Stand Marked for Cutting
Hog Lake Compartment - Happy Camp-Lava Beds Area.

Acres in Sample	Green Stand No.of Trees	Green Stand Volume	Green Stand Volume per acre	Marked for Cutting No.of Trees	Marked for Cutting Volume BM	Marked for Cutting Volume per acre	Marked for Cutting Percent Green
40.0	-	419,850	10,500	114	125,070	3,127	29.8
18.0	169	154,190	8,570	34	42,530	2,363	27.6
10.0	172	150,030	15,000	31	57,180	5,718	38.0
10.0	153	69,230	6,920	15	20,090	2,009	29.0
10.0	191	157,480	15,750	21	42,950	4,295	27.3
10.0	172	117,810	11,780	17	21,960	2,196	18.6
10.0	147	104,010	10,400	37	38,940	3,894	37.4
10.0	131	84,410	8,440	19	21,850	2,185	25.9
10.0	166	153,750	15,380	30	43,600	4,360	28.4
10.0	106	52,740	5,270	6	13,870	1,387	26.3
10.0	121	88,550	8,860	25	35,640	3,564	40.2
20.0	323	257,840	12,890	54	73,930	3,696	28.7
Total 168.0	1,851	1,809,890		403	537,610		
Average			10,770			3,200	29.7

The cutting program was begun during April and was continued throughout the season. The South end of the sale area was first to be cut. As the program of cutting was extended, roads were constructed through the areas where the most trees had been marked. The yarding of logs to landings along the roads was done with caterpillars equipped with arches. A portable boom was used to load the log trucks and from 7,000 - 8,000 board feet per truck was hauled about 13 miles to the mill at Canby. During the course of the season approximately 8,192,000 board feet of timber was removed from about 4 sections in the sale area.

EFFECTIVENESS OF TREATMENT IN REDUCING SUBSEQUENT LOSS

Past Loss Record.

A record of past loss on parts of the Happy Camp - Lava Beds Area of the Modoc National Forest has been maintained annually by the Berkeley Forest Insect Laboratory since 1922. On the Hog Lake Compartment, the west half of section 10, T. 43N.; R.8E.; MDM has been cruised at yearly intervals since 1925. Another 320-acre plot (MC-6) on the north half of section 35, T.43N.; R.8E., which is representative of the sale area, has been cruised annually since 1930. These two plot records show that the loss in this pine timber for the past 17 years has averaged 232 board feet per acre annually. The cumulative loss for the period of record, 3,939 board feet per acre, represents approximately 28 percent of the original green stand.

An additional record of the amount of past loss on the Hog Lake Compartment was secured by the Hazard Inventory Cruise in 1939. On the same sample strips that were used for determining stand resources (Table 1), the measured loss incurred during the past 12-15 years has averaged 181 board feet per acre per year. The range in loss and the proportion of the green stand killed annually is shown in the following table.

Table 3. Record of Past 12-15 Years' Loss. Hog Lake Compartment. Happy Camp - Lava Beds Area.

	ORIGINAL GREEN STAND PER ACRE		AVER.ANNUAL LOSS - 12-15 year period			
Acres in Sample	No.of Trees	Volume BM	No.of Trees	Volume BM	Volume per acre	Percent Green
8.0	15.9	17,900	2.5	2,930	366	2.0
8.0	11.1	9,910	0.5	907	113	1.1
8.0	15.3	13,940	1.2	1,527	191	1.4
8.0	18.3	11,530	0.9	1,651	206	1.8
7.0	8.6	7,960	0.9	949	136	1.7
6.6	8.8	8,240	0.7	955	145	1.8
8.0	17.6	16,470	3.3	3,294	412	2.5
4.6	11.7	9,160	0.7	749	163	1.8
4.7	13.2	10,970	1.1	909	193	1.8
6.3	8.7	10,020	0.3	421	67	0.7
5.1	14.3	12,580	0.4	368	72	0.6
4.0	15.5	11,810	0.5	509	127	1.1
5.5	11.1	9,790	0.4	743	135	1.4
4.8	6.9	6,690	0.3	422	88	1.3
2.0	16.0	8,340	0.2	37	19	0.2
Average	12.9	11,020	0.9	1,091	181	1.6

Losses Subsequent to Cutting.

By comparing the amount of loss on the cut area to that on surrounding uncut stands, it is possible to determine what effectiveness the cutting has had in reducing insect-caused loss. During late October, 1942, that portion of the sale area that was cut during early spring and summer months was cruised for current loss. A five-mile sample strip, 10 chains wide, was made through sections 16, 17, 20 and 21. No current loss was found on this 400-acre sample. Also, while driving over the roads through the cut area, no currently infested trees were noticed. The complete absence of current loss on the cut area made it unnecessary to expand the sample area into the cuttings made during the late summer and fall months.

In the virgin stands surrounding the treated area, three half-section sample plots were cruised for current insect-caused loss during late October. A summary of the 1942 infestation found in virgin areas is given in table 4. Since no current loss was found where cutting had been done, it may be concluded that thus far, during the season of 1942, the selective logging treatment has been thoroughly effective in preventing losses caused by insects.

Table 4. Summary of 1942 Insect Loss on Virgin Areas Surrounding Hog Lake Sale Area.

Plot No.	Acres in Sample	Record of Loss for 1942		
		No. of trees	Volume B.M.	Volume per acre
RS-5	300	7	5,470	18
MC-6	320	1	1,100	34
MC-7	300	5	5,490	18
Total	920	13	12,060	
Average				13

DISCUSSION

The current infestation on the Happy Camp - Lava Beds Area is very low in comparison to previous years and the apparent 100 percent effectiveness of the sanitation-salvage treatment during the year of 1942 may not be as significant as it would seem. The Hog Lake Compartment is not far removed from the area of high hazard in the Badger Unit to the north and it is entirely possible that beetle populations likely to develop in this high hazard zone may find their way into this cut area to attack the low risk reserve stand. It should be emphasized that the removal of high risk trees from an area does not provide immunity to the reserve trees from subsequent bark beetle attack, nor does the single coverage of an area allow for long-term protection against future insect outbreaks. The light selective sanitation-salvage treatment is designed to reduce losses subsequent to cutting for a relatively short period. The degree and extent of protection secured by the light treatment can only be determined by an elapse of time.

Under normal endemic western pine beetle infestations the lack of resistance of the host tree seems to be the primary factor in tree selection and a majority of all trees attacked and killed are decadent types (high risk). Under the influence of high populations as the numbers of beetles increase, there is less of a selection by the

beetles for only the high risk trees. However, from studies in other areas, it has been found that the sanitation-salvage treatment in some way upsets the course of the normal infestation and an area selectively treated is protected to a higher degree than would be indicated by the proportional occurrence of loss in low and high risk groups on surrounding virgin areas. It can be expected that the findings from other studies will also hold true on the Hog Lake Compartment, and the sustained loss in surrounding virgin stands will be considerably above that on areas where the treatment has been practiced, regardless of the trend in infestations.

During the sample cruise of the treated area during October, attention was given to several aspects of the sanitation-salvage agreement which are of importance in the commercial application of the light selective logging treatment. (1) Were all high risk trees detected and marked for cutting as the area was covered by the timber markers? (2) Were all of the trees that were marked, located and felled during operations? (3) Were any of the felled trees overlooked and left in the woods during yarding?

On the five miles of cruise strip, two trees were noticed that should have been recognized as being high risk and, therefore, marked for cutting. These two trees were merely overlooked and missed in marking as both were obvious high risk types. One small suppressed tree was found that had been marked for cutting, but missed by the fallers. In this case the tree was isolated from other high risk trees and, because of its position, escaped notice as the other trees in this vicinity were felled. There were no felled trees noticed that were not picked up in yarding. It is the writer's judgment that the entire sale agreement from marking through loading was thorough and complete.

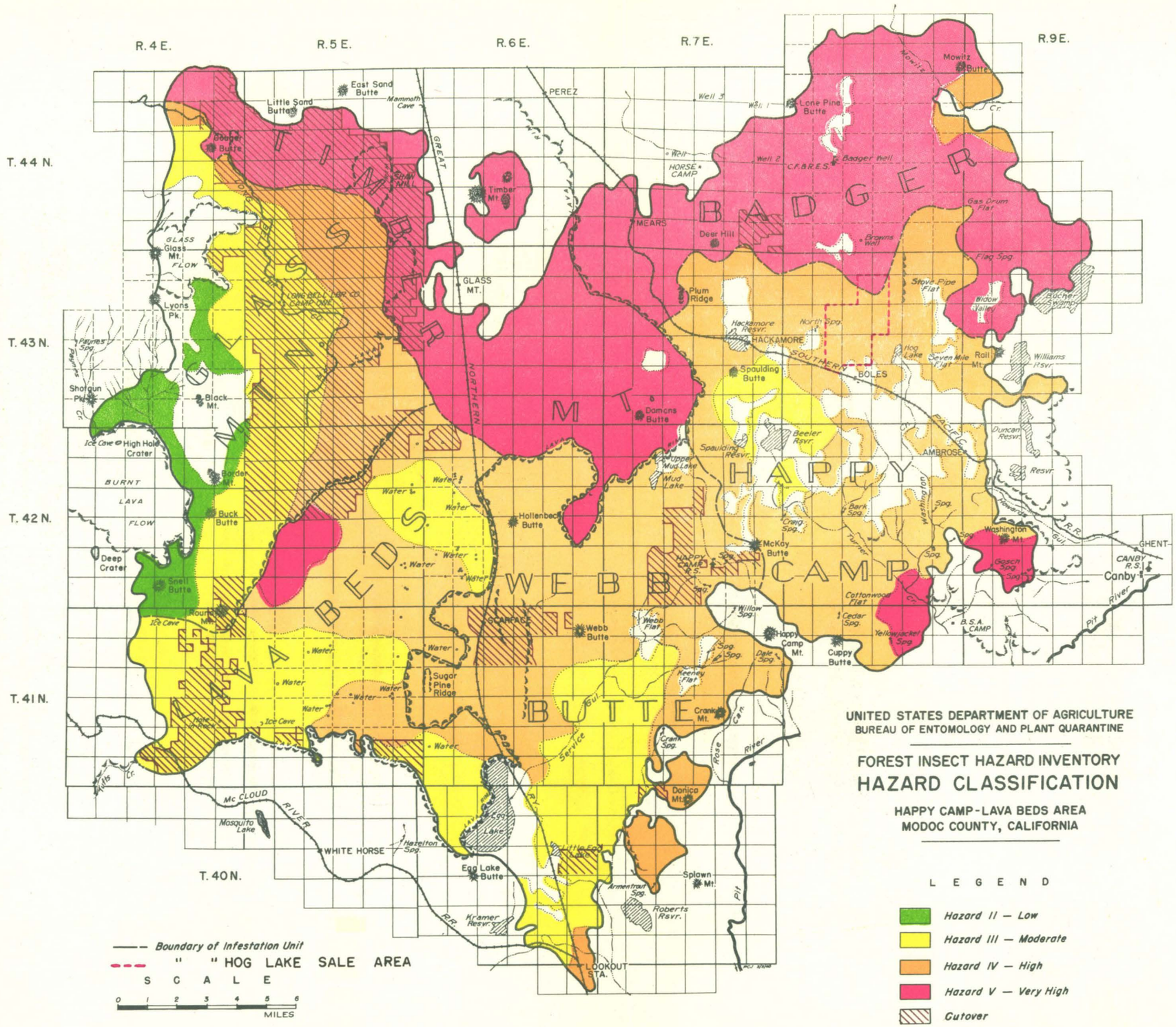
SUMMARY

Early in 1942, the U. S. Forest Service culminated several years of effort to initiate intensive forest management in a portion of the Happy Camp - Lava Beds Area on the Modoc National Forest by making an exchange sale agreement with the R. L. Smith Company for the selective cutting of the Hog Lake Compartment as an indirect insect control. measure. The timber sale contract provided that a minimum of 25 percent of the merchantable stand would be cut all in trees judged as being highly susceptible to insect attack. The sale area was marked for cutting during April and operations were begun early in May. During the course of the season approximately 8,192,000 board feet of timber were removed from about 4 sectionsin the sale area.

The green stand on the Hog Lake Compartment averaged from 9,000 - 11,000 board feet per acre, of which 20 percent was made up of high risk trees. When borderline trees in the risk 2 group were added to the high risk volume to provide for the minimum cut of 25 percent of the stand, it was found that 29.7 percent of the merchantable volume on the area was to be removed.

In reviewing the history of loss on the sale area, it was found that from 181-232 board feet per acre had been killed annually since the records of loss were first started in 1925. For a period of 17 years, about 28 percent of the original green stand has been killed as a result of attacks by insects.

Subsequent to the cutting operations in 1942, no current loss was found within the sale area. On surrounding virgin areas the current loss averaged 13 board feet per acre. Thus far, for the first season, the light cutting has been thoroughly effective in reducing losses, but because of the relatively low current infestation in the surrounding virgin areas, the apparent 100 percent reduction in loss may not represent a perfectly true picture of the effectiveness of the cutting during the first year. From sample cruise strips within the sale area, the writer was convinced that the sale agreement was thorough and complete and highly satisfactory from all standpoints as a method for the utilization of susceptible timber and the indirect control of insects.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TIMBER MTS.
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PEREZ
HACKAMORE
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BOLES
HAPPY CAMP
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Canby
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Egg Lake Butte
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Mowitz Butte
Lone Pine Butte
East Sand Butte
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Badger Butte
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Shotgun Pk.
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Splawn Mt.
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Beeler Resvr.
Duncan Resvr.
Williams Resvr.
Kramer Resvr.
Roberts Resvr.
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Upper Mud Lake
Mosquito Lake
Hazelton Spg.
Armentrout Spg.
Cottonwood Flat
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Gas Drum Flat
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Seven Mile Flat
Flag Spg.
North Spg.
Bark Spg.
Crag Spg.
Willow Spg.
Cedar Spg.
Yellowjacket Spg.
Dale Spg.
Gasoline Spg.
Spg.
Well 1
Well 2
Well 3
Badger Well
Brawns Well
Mowitz Cr.
Cr.
Gulch
Creek
River
Pit River
Rose Cam
Service
Mc CLOUD RIVER
Little Egg Lake
Egg Lake
Water
Ice Cave
Lava Flow
Burnt Lava Flow
Long Bell Lbr. Co. Camp One
C.F.B.R.E.S.
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Happy Camp R.S.
Great Northern
Pacific
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Boundary of Infestation Unit
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SCALE
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UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE
FOREST INSECT HAZARD INVENTORY
HAZARD CLASSIFICATION
HAPPY CAMP-LAVA BEDS AREA
MODOC COUNTY, CALIFORNIA
LEGEND
Hazard II — Low
Hazard III — Moderate
Hazard IV — High
Hazard V — Very High
Cutover